

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. APPLN. NO.: 10/588,775

DOCKET NO.: Q96219

AMENDMENTS TO THE DRAWINGS

Submitted herewith please find two (2) sheets of replacement drawings in compliance with 37 C.F.R. § 1.84. FIGS. 1-3 have been amended to add the label of --PRIOR ART--. The Examiner is respectfully requested to acknowledge receipt of these drawings.

The submitted drawings are intended to replace the drawings previously submitted.

Attachment: Two Replacement Sheet(s) (FIGS. 1-4)

REMARKS

Reconsideration and allowance of this application are respectfully requested. New claims 9-15 have been added. Support is found in the specification in at least paragraphs [0035] and [0036] and FIGS. 4-9. Claims 1-15 are now pending in the application.

Objection to the Drawings

Figures 1-3 have been objected to by the Examiner. Accordingly, Applicants have amended FIGS. 1-3 to add the label of --PRIOR ART--. Withdrawal of the objection to the drawings is respectfully requested.

Objection to the Specification

The disclosure has been object to because of alleged informalities. Accordingly, Applicants have editorially amended paragraph [0022] of the specification to improve clarity. Applicants also maintain that the acronyms used throughout the specification are those commonly used by and understood by one of ordinary skill in the art. Withdrawal of the objection to the specification is respectfully requested.

Objection to the Claims

Claims 1-8 have been objected to because of alleged informalities. Accordingly, in view of the Examiner's suggestions, claims 1 and 5-8 have been editorially amended to improve clarity. Withdrawal of the objection to the claims is respectfully requested.

Rejection Under 35 U.S.C. § 112, Second Paragraph

Claims 1-8 have been rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Applicants have editorially amended claims 1, 3 and 4 to improve clarity. Reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, are respectfully requested.

Rejection Under 35 U.S.C. § 103(a) - Shur et al. in view of Shirai

Claims 1-4 and 6-8 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the combination of Shur et al. (U.S. Patent Publication No. 2005/0087752; hereafter “Shur”) in view of Shirai (U.S. Patent No. 5,422,505). The rejection is respectfully traversed.

Neither Shur nor Shirai, either alone or in combination, teach or suggest the claimed invention as recited by claim 1.

Shur discloses a semiconductor structure creating a field effect transistor as shown in FIG. 5. However, as conceded by the Examiner on page 5 of the Office Action, “Shur et al. fails to show a thickness of a portion of said insulating film lying between said field plate portion and said semiconductor layer structure gradually increases from said gate electrode towards said drain electrode.” As shown in Shur’s FIG. 5, the thickness of the dielectric second layer (218) lying between the first field plate (230) and the semiconductor layer (212) does not change.

Shirai does not remedy the deficiencies of Shur. In Shirai, a field effect transistor is disclosed to include a gate insulating film (14) which is thickened at least in a two-step manner in a direction from a source region (11) to a drain region (12), as shown in FIG. 1. However, Both Shur and Shirai are directed towards a completely different structure than the claimed

invention. Exemplary embodiments of the present invention refer to a gate electrode which is arranged in Schottky contact and which has a field plate portion that projects to a drain electrode in the form of an eave and is formed on an insulating film. Contrarily, Shur and Shirai refer to a metal-insulator-semiconductor (MIS) type gate structure.

Exemplary embodiments of the present invention aim to enhance the gate breakdown voltage and to suppress collapse by reducing concentration of the electric field to the gate edge between the gate and the drain. On the other hand, Shirai aims to realize a uniform distribution of an electric field in MOSFET by varying the thickness of the gate insulating film of the MIS type gate structure. As such, the claimed invention is very different from both Shur and Shirai in purpose and structure. Therefore, due at least to this deficiency in both Shur and Shirai, the claimed invention is distinguished over Shur in view of Shirai.

Claims 2, 3 and 6-8 are dependent claims which are also distinguished over Shur in view of Shirai for at least the aforementioned reasons as discussed above, as well as for their additionally recited elements.

With regards to claim 4, in the claimed field effect transistor, "said thickness of said portion of said insulating film varies continuously." The Examiner has relied upon Shirai's FIG. 1 for this teaching, however, Shirai only discloses that "the thickness of the gate insulating film 14 of the MOSFET is thickened at least in a two-step (four-step in this embodiment) manner in a direction from the source side to the drain side" (column 2, lines 55-59). Therefore, because the thickness of Shirai's gate insulating film (14) clearly varies in a step-wise manner, such would fail to teach or suggest a *continuous variation* of thickness. Increasing thickness in a step-wise manner as disclosed by Shirai is very different from, and therefore not teaching or suggestive of

a continuous variation of thickness. A step-wise manner is necessarily not continuous.

Therefore, the claimed invention as recited by claim 4 is distinguished over Shur in view of Shirai. Reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a) are respectfully requested.

Rejection Under 35 U.S.C. § 103(a) - Martinez et al. in view of Shirai

Claims 1-5 and 8 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the combination of Martinez et al. (U.S. Patent Publication No. 2003/0235974; “Martinez”) in view of Shirai. The rejection is respectfully traversed.

Neither Martinez nor Shirai, either alone or in combination, teach or suggest the claimed invention as recited by claim 1.

Martinez discloses an RF enhancement mode FET as shown in FIG. 3. However, as conceded by the Examiner on page 8 of the Office Action, “Martinez et al. fails to show a thickness of a portion of said insulating film lying between said field plate portion and said semiconductor layer structure gradually increases from said gate electrode towards said drain electrode.” As shown in Martinez’s FIG. 3, the thickness of the SiON layer (38) lying between the overhang of the material of the gate (42) and the cap layer (35) does not change.

Shirai does not remedy the deficiencies of Martinez. As discussed above, Shirai’s refers to a MIS type gate structure which aims to realize a uniform distribution of an electric field in MOSFET by varying the thickness of the gate insulating film of the MIS type gate structure. To the contrary, in exemplary embodiments of the present invention, a gate electrode arranged in Schottky contact has a field plate portion that projects to a drain electrode in the form of an eave and is formed on an insulating film. As such, the claimed invention is very different from Shirai

in purpose and structure. Therefore, due at least to this deficiency in both Martinez and Shirai, the claimed invention is distinguished over Martinez in view of Shirai.

Claims 2, 3, 5 and 8 are dependent claims which are also distinguished over Martinez in view of Shirai for at least the aforementioned reasons as discussed above, as well as for their additionally recited elements.

With regards to claim 4, the Examiner has again relied upon Shirai for the teaching that “said thickness of said portion of said insulating film varies continuously.” However, as also discussed above, the thickness of Shirai’s gate insulating film (14) clearly varies in a step-wise manner, and thus would fail to teach or suggest a continuous variation of thickness. Therefore, the claimed invention as recited by claim 4 is distinguished over Martinez in view of Shirai. Reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a) are respectfully requested.

Newly Added Claims

Claims 9-15 are newly added by this amendment, and are also distinguished over the cited references in view of their dependencies as well as for their additionally recited elements.

With particular regard to claim 11, “a thickness of said field plate portion gradually decreases from said gate electrode towards said drain electrode.” Neither Shur, Martinez nor Shirai, either alone or in combination, teach or suggest these further elements.

In Shur, the thickness of the first field plate (230) does not gradually decrease from the gate (222) toward the drain contact (226). As shown in Shur’s FIG. 5, the thickness of the first field plate (230) remains the same between the gate (222) and the drain contact (226). Likewise, in Martinez, the thickness of the material of the gate (42) also does not gradually decrease from

the portion of the gate (42) formed in the opening, toward the drain ohmic contact (40). As also shown in Martinez's FIG. 3, the thickness of the material of the gate (42) which rests upon the SiON layer (38) remains a constant thickness.

Shirai does not remedy the deficiencies of Shur or Martinez. In Shirai, gate electrode (G) maintains a consistent thickness at every point between the source region (11) and the drain region (12). Therefore, Shirai also fails to teach or suggest that "a thickness of said field plate portion gradually decreases from said gate electrode toward said drain electrode," as recited by claim 11. Therefore, due at least to this deficiency in both Shur, Martinez and Shirai, the claimed invention as recited by claim 11 is distinguished over Shur, Martinez and Shirai, either alone or in combination, at least for these additional elements as well as due to its dependency upon independent claim 1.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Respectfully submitted,



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